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Foreword

Special issue on learning theory

This special issue collects some of the very best learning theory papers of 2004. They are chosen from a variety of top conferences: the ACM Symposium on Theory of Computing (STOC), the Conference on Learning Theory (COLT), the IEEE Symposium on Foundations of Computer Science (FOCS), and the Conference on Uncertainty in Artificial Intelligence (UAI).

The paper of Bisht, Bshouty, and Khoury resolves a major open problem in the area of query learning, by establishing general learnability results in the presence of malicious noise. The work of Aleknovich, Braverman, Feldman, Klivans, and Pitassi uses methods from proof complexity to get new learning algorithms for hard concept classes like DNF, and at the same time obtains new hardness results for some of these problems. Klivans and Servedio tackle the challenging problem of learning intersections of halfspaces, using a combination of random projections and kernel methods. Kleinberg and Sandler analyze collaborative filtering by considering a partition of items into clusters, where the preferences of users are distributions over these clusters; they provide algorithms which learn enough about these underlying distributions to give good recommendations to users. The result of Kempe and McSherry is a decentralized algorithm for finding the top eigenvectors of a symmetric matrix. McAllester, Collins, and Pereira introduce a new family of probabilistic models that admits efficient inference and includes as special cases both bounded-treewidth Markov random fields and probabilistic context-free grammars. The paper of Kleinberg and Awerbuch presents an algorithm for online linear optimization, and a more specific algorithm for the online shortest path problem. Finally, the work of Kakade and Foster provides a learning process for game playing in which the joint frequency of empirical play is close to a Nash equilibrium on all but a vanishing fraction of rounds. The diversity of topics in these papers—query learning, proof complexity, high-dimensional geometry, recommender systems, matrix operations, probabilistic graphical models, online optimization, and game theory—is a reflection of the impressive breadth of learning theory and the wide applicability of its methods.

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